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ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION

# Stand Volume Tables

# for

# Immature Ponderosa Pine in the Black Hills

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The volume tables presented here give direct estimates of total and merchantable cubic-foot volumes per acre for immature ponderosa pine stands in the Black Hills. The tables provide a timesaving shortcut for determining stand volumes, since they eliminate the need for summing estimates for individual trees or size classes.

Table 1 gives estimates of total cubic-foot volume per acre, including stumps and upper stemwood of all trees. Two values are required to use this table: (1) basal area of the stand, in square feet per acre, and (2) average total height of dominant and codominant trees, in feet.

Table 2 provides estimates of stand merchantable volume, in trees 6.0 inches d.b.h. and larger, exclusive of volume in upper stemwood smaller than 4.0 inches d.i.b. and in stumps 0.5 foot high. Use of this table also requires two values: (1) basal area of trees larger than 5.9 inches d.b.h., in square feet per acre, and (2) average total height of dominants and codominants, in feet.

Basal areas can be obtained from either plots or point samples, well distributed throughout the stand. The height value required by both tables should be an arithmetic average of total heights of five or more dominants and codominants on each plot or near each point where basal area is measured. When volume estimates are made for sapling or pole stands that have an overstory composed of remnants of a parent stand, the overstory trees should be excluded from the basal area and height samples.

These volume tables were derived from data collected by Myers and Van Deusen on 60 sample plots used in a study of periodic growth in immature pine stands in the Black Hills.[2] Graphic analysis of the data revealed a strong linear correlation between total cubic-foot volume per acre and the product of basal area times average total height of dominants

and codominants. A regression line was fitted to the data by the method of least squares:

$$V_T = 0.392\ B_T H$$

where $V_T$ = stand volume in cubic feet per acre, $B_T$ = basal area per acre, all stems in square feet, and H = average total height of dominants and codominants, in feet.

Stand merchantable volume was similarly correlated with basal area of merchantable trees and average total height of dominants and codominants. Another least-squares regression equation was computed for that relationship:

$$V_M = 0.372\ B_M H - 96.3$$

where $V_M$ = stand merchantable volume in cubic feet per acre, $B_M$ = basal area of all trees larger than 5.9 inches d.b.h., in square feet per acre, and H = average total height of dominant and codominant trees.

These two equations were used to compute the volumes shown in the tables. They can also be used to obtain volume estimates for combinations of basal area and average height in between those given in the tables.

Merchantable cubic-foot volumes may be converted to standard cord measure by applying appropriate conversion factors. For an estimate of the number of rough (unpeeled) cords per acre, divide merchantable cubic-foot volume by 77. For an estimate of the number of cords of peeled wood, divide merchantable cubic-foot volume by 98.[3] Cord estimates thus obtained will be sufficiently accurate for most purposes, although probable limits of error cannot be given.

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[2] *Myers, Clifford A., and Van Deusen, James L. Growth of immature stands of ponderosa pine in the Black Hills. U.S. Forest Serv. Rocky Mountain Forest and Range Expt. Sta. Sta. Paper 61, 14 pp., 1961.*

[3] *Woodfin, R. O., Jr., and Landt, E. F. Conversion of cubic-foot volumes of Black Hills ponderosa pine to cords. U.S. Forest Serv. Rocky Mountain Forest and Range Expt. Sta. Res. Note 31(Rev.) 2 pp. 1960.*

Table 1.--Total cubic-foot volume for immature stands of ponderosa pine in the Black Hills of South Dakota and Wyoming

| Cubic feet per acre, entire stems, inside bark | Average total height of dominant and codominant trees | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Stand basal area, all stems | Average total height, feet | | | | | | | |
| | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 |
| Sq. ft./acre | Volume per acre, cubic feet | | | | | | | |
| 10 | 78 | 118 | 157 | 196 | | | | |
| 20 | 157 | 235 | 314 | 392 | | | | |
| 30 | 235 | 353 | 470 | 588 | | | | |
| 40 | 314 | 470 | 627 | 784 | | | | |
| 50 | 392 | 588 | 784 | 980 | | | | |
| 60 | 470 | 706 | 941 | 1176 | | | | |
| 70 | 549 | 823 | 1098 | 1372 | | | | |
| 80 | 627 | 941 | 1254 | 1568 | 1882 | | | |
| 90 | 706 | 1058 | 1411 | 1764 | 2117 | | | |
| 100 | 784 | 1176 | 1568 | 1960 | 2352 | | | |
| 110 | 862 | 1294 | 1725 | 2156 | 2587 | | | |
| 120 | 941 | 1411 | 1882 | 2352 | 2822 | | | |
| 130 | 1019 | 1529 | 2038 | 2548 | 3058 | | | |
| 140 | 1098 | 1646 | 2195 | 2744 | 3293 | 3842 | 4390 | |
| 150 | 1176 | 1764 | 2352 | 2940 | 3528 | 4116 | 4704 | 5292 |
| 160 | 1254 | 1882 | 2509 | 3136 | 3763 | 4390 | 5018 | 5645 |
| 170 | 1333 | 1999 | 2666 | 3332 | 3998 | 4665 | 5331 | 5998 |
| 180 | 1411 | 2117 | 2822 | 3528 | 4234 | 4939 | 5645 | 6350 |
| 190 | 1490 | 2234 | 2979 | 3724 | 4469 | 5214 | 5958 | 6703 |
| 200 | 1568 | 2352 | 3136 | 3920 | 4704 | 5488 | 6272 | 7056 |
| 210 | 1646 | 2470 | 3293 | 4116 | 4939 | 5762 | 6586 | 7409 |
| 220 | 1725 | 2587 | 3450 | 4312 | 5174 | 6037 | 6899 | |
| 230 | 1803 | 2705 | 3606 | 4508 | 5410 | | | |
| 240 | 1882 | 2822 | 3763 | 4704 | | | | |
| 250 | 1960 | 2940 | 3920 | 4900 | | | | |
| 260 | 2038 | 3058 | 4077 | 5096 | | | | |

Blocks indicate extent of basic data.
Standard error of estimate = 79.7 cubic feet = 3.5 percent at mean volume.

Table 2.--Merchantable cubic-foot volume for immature Stands of ponderosa pine in the Black Hills of South Dakota and Wyoming

Cubic feet per acre, excluding 0.5-foot stumps and stemwood less than 4.0 inches d.i.b.

Average total height of dominant and codominant trees

| Basal area in trees larger than 5.9 inches d.b.h. | Average total height, feet | | | | | |
|---|---|---|---|---|---|---|
| | 20 | 30 | 40 | 50 | 60 | 70 |
| Sq. ft./acre | Volume per acre, cubic feet | | | | | |
| 10 | | 15 | 52 | | | |
| 20 | 52 | 127 | 201 | | | |
| 30 | 127 | 238 | 350 | | | |
| 40 | 201 | 350 | 499 | 648 | | |
| 50 | | 462 | 648 | 834 | 1020 | |
| 60 | | 573 | 796 | 1020 | 1243 | 1466 |
| 70 | | 685 | 945 | 1206 | 1466 | 1726 |
| 80 | | 796 | 1094 | 1392 | 1689 | 1987 |
| 90 | | 908 | 1243 | 1578 | 1912 | 2247 |
| 100 | | 1020 | 1392 | 1764 | 2136 | 2508 |
| 110 | | 1131 | 1540 | 1950 | 2359 | 2768 |
| 120 | | 1243 | 1689 | 2136 | 2582 | 3028 |
| 130 | | 1354 | 1838 | 2322 | 2805 | 3289 |
| 140 | | | 1987 | 2508 | 3028 | 3549 |
| 150 | | | 2136 | 2694 | 3252 | 3810 |
| 160 | | | 2284 | 2880 | 3475 | 4070 |
| 170 | | | 2433 | 3066 | 3698 | 4330 |
| 180 | | | 2582 | 3252 | 3921 | 4591 |
| 190 | | | 2731 | 3438 | 4144 | 4851 |
| 200 | | | 2880 | 3624 | 4368 | |
| 210 | | | 3028 | 3810 | 4591 | |

Blocks indicate extent of basic data.
Standard error of estimate = 80.6 cubic feet = 5.8 percent at mean volume.

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